American Science and Engineering Inc.

Testimony to
U.S. House Committee on Homeland Security
13 July 2005

Chairman Cox, Ranking Member Thompson and Members of the Committee on Homeland Security, on behalf of American Science and Engineering Inc., we would like to thank you for the opportunity to speak today about how to make our airports safer and our traveling public more secure. We believe security checkpoints at our nation's airports can and should be more effective. Today, I would like to tell you about a technology invented and patented by our company, called Backscatter X-ray Imaging. Backscatter has been the technology of choice for protecting most high threat facilities around the World, including the Russell and Dirksen Senate Office Buildings. Backscatter can provide a much higher level of detection over a broader range of threats than any technology currently employed at airports for inspecting carry-on baggage and people. Backscatter can identify small metal objects, such as detonator wires, non-metallic weapons, such as ceramic knives, and very small amounts of explosives in a sealed packet. The U. S. Military is also using Backscatter to effectively find Improvised Explosive Devices hidden in vehicles and on people in the theater of operations, Iraq. Over 50 systems are currently deployed, with more on the way.

TSA recognizes the advantages of using Backscatter X-ray Imaging for finding potential threats hidden on people and in carry-on baggage, and recently announced plans to pilot Backscatter for personnel screening at airport checkpoints. The Department of Homeland Security (DHS), Office of Inspector General (OIG) reported in September 2004 on its "Audit of Passenger and Baggage Screening Procedures at Domestic Airports". After suggestions by the OIG were implemented by TSA following this report, the audit was repeated and a follow-on report was issued in March 2005. The March 2005 report stated that the quantity of threats that go undiscovered through our current airport check points is still unacceptable. The study's conclusion was that the "majority of screeners…were diligent in the performance of their duties" and that "the lack of improvement since [the] last audit indicates that significant improvement in performance may not be possible without greater use of technology." The report concludes by "encourag[ing] TSA to expedite its testing programs and give priority to technologies, such as backscatter x-ray, that will enable the screening workforce to better detect both weapons and explosives."

First let me tell you briefly what Backscatter is and why it is unique. X-rays do one of three things when they impinge on an object or person: they pass through, get absorbed or scatter. If the object is not very dense, they would pass through without stopping. If the object is dense, like metal, they might get absorbed. The difference of what goes through versus what gets absorbed is used to map the dense contents of an object and to make a determination if there is something in the image worth worrying about. An example in medicine would be a conventional chest X-ray. This technique, called transmission X-ray, is also used today to determine if there is a threat in your carry-on bag. However, if the object is made of or contains an organic material, such as explosives, it might be very hard to see in Transmission X-rays. The difference between what gets through versus what gets absorbed is not great enough to make a good diagnosis.

However, organic materials scatter X-rays in all directions, including backwards. By creating an image of the back scattered X-rays we can identify the presence of those organic materials, including explosives.

At today's airports two techniques are used for inspecting carry-on baggage, Transmission X-rays and Trace Wipes. First your bag is sent through a Transmission X-ray scanner. We've all done this, you put your bag on a conveyor, an image is taken as it goes through the machine and a TSA inspector determines if you are carrying a threat. If they can't make a definitive determination, they might put your bag through a second time or send it to another station where a wipe of the outside of your bag would be analyzed for traces of explosive residue. If the explosive material is missed during the X-ray, it may never go to a secondary "wipe" screen and would be missed.

Figures 1, 2 and 3 of appendix "A" illustrates how Backscatter helps identify objects missed in baggage by conventional X-ray imaging. Figure 1 is a Transmission X-ray image of a briefcase with a laptop computer containing 3 explosive devices. The image was taken with a system currently used at airport checkpoints. Figure 2 shows the same image after "dual-energy" processing to highlight explosives. Only 1 explosive is revealed.

A Backscatter X-ray image of the same bag with the laptop is shown in figure 3. In this image all three explosive devices are clearly seen. Today, two potential threats would likely have gone undetected.

Let's now consider threats hidden on a passenger. Backscatter technology is particularly well suited to identifying threats on a person.

Today, airport security checkpoints primarily use metal detectors to find threats concealed on travelers. There are three fundamental limitations of metal detectors:

1. First, they only alarm on metal objects, leaving many non-metallic weapons and explosive devices undetected.
2. Second, the size of the metal object detected is subject to the nuisance alarm threshold setting. Small metallic objects, such as a plastic handled box knife may go undetected.
3. Third, alarms need to be resolved by another person or device. Portable metal detector wands and pat-downs are often used. This slows the process, is labor intensive and is subject to the competency and thoroughness of the person performing the function. Pat-downs are considered by many to be very intrusive and have been met with substantial resistance by the traveling public.

Recognizing that metal detectors can not find explosive devices, TSA has recently tested trace portals at airports. These devices can identify trace amounts of explosives if residue from one explosive material is present on the person or their clothing. If the explosives are sealed or if there is no residue, the explosives may go undetected, regardless of their size. In addition, there are classes of explosives that do not give off enough trace materials to trigger an alarm.

Therefore, even when using both metal detectors and trace portals, several classes of threats may go undetected and be carried onboard aircraft. They include:

- Metal weapons smaller than the metal detector threshold setting.
- Sealed explosives with no residue trace.
- Non-metallic weapons such as ceramic knives and composite pistols.
- Weapons or explosives concealed in sensitive areas of the body.

Backscatter X-ray Imaging though, provides the broadest range of detection capability when used to scan people, including those threats just described. It is almost impossible to hide a threat on the human body that goes undetected by Backscatter.

Backscatter imaging is very safe. The X-ray exposure from a Backscatter scan is equivalent to the exposure received from background in only three minutes when flying in an airplane at altitude.

The amount of radiation exposure given to the person during the procedure is extremely small. The National Committee for Radiological Protection & Measurement have determined that up to 5000 scans per year are safe for even the most sensitive class of people, including pregnant women and children. It is equivalent to the exposure received from background when flying in an airplane at altitude for just a few minutes.

Figure 4 of Appendix "A" is a Backscatter image of a person hiding several types of threats beneath their clothing. As you can see, threats including handguns, knives, and explosive material are clearly detectable.

This unfiltered Backscatter X-ray creates a detailed image of the subject. Our company and TSA appreciate the sensitive nature of these images, and we have worked diligently with TSA to develop approaches to address privacy concerns. By physically separating the scanned person from the image reviewer and using gender-specific reviewers, some privacy concerns may be eased. However, AS&E has gone a step further and developed software algorithms for modifying the images to highlight potential threats and yet diminish the image in sensitive regions of the body. Figure 5 of Appendix "A" shows the privacy enhanced image which is the only image seen by the reviewer. The reviewer never sees the original unfiltered image nor do they have an opportunity to save or display the image elsewhere. Figure 6 is another sample image in which the explosive is highlighted by the computer in red.

American Science and Engineering stands ready to deploy its Backscatter personnel scanners at airports today with software algorithms to address privacy concerns. Backscatter X-ray Imaging detects the broadest range of threats, including metallic weapons, non-metallic weapons, and explosives by providing a clear and unambiguous image of the threat. With Backscatter systems there should be little need to resolve false alarms with a second security person or method, thereby improving the efficiency of the screening process.

We urge the Members of this Committee to support DHS and TSA in their plans to deploy available Backscatter systems at airports as soon as possible. The security of our nation and the safety of its traveling public will be the better for it.

Appendix “A”
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Figure 1:

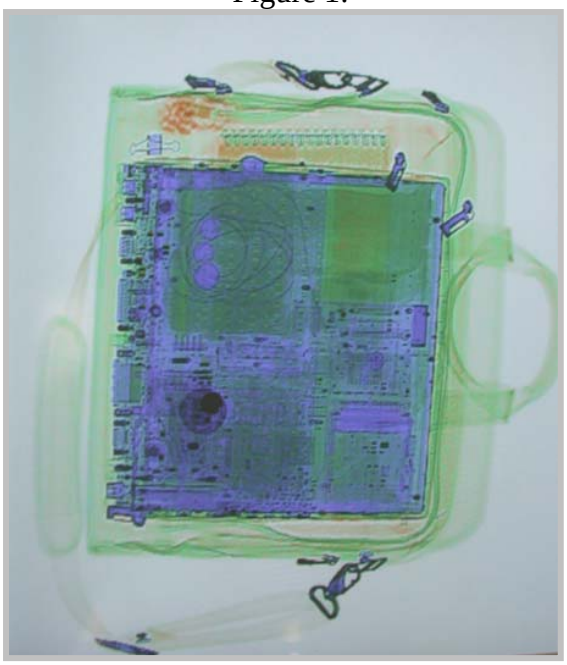


Figure 2:

Figure 3:

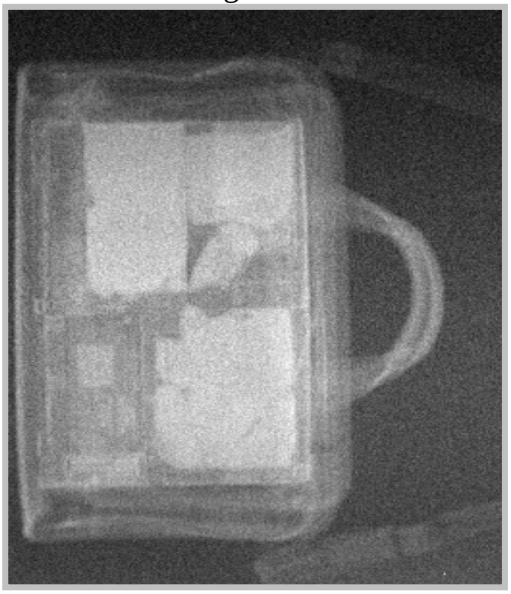
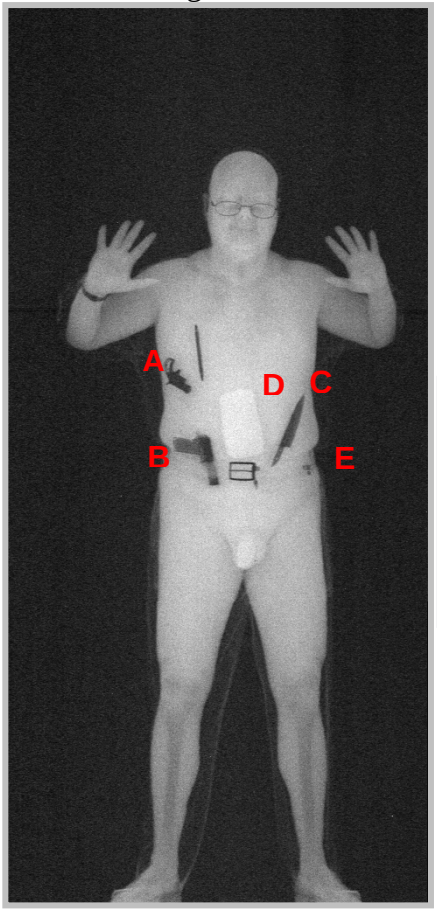


Figure 4:



Threats Key:

A = 22 caliber Pistol
B = Pistol
C = Ceramic Knife
D = C4 Explosive
E = Folded Metal Knife

Figure 5:

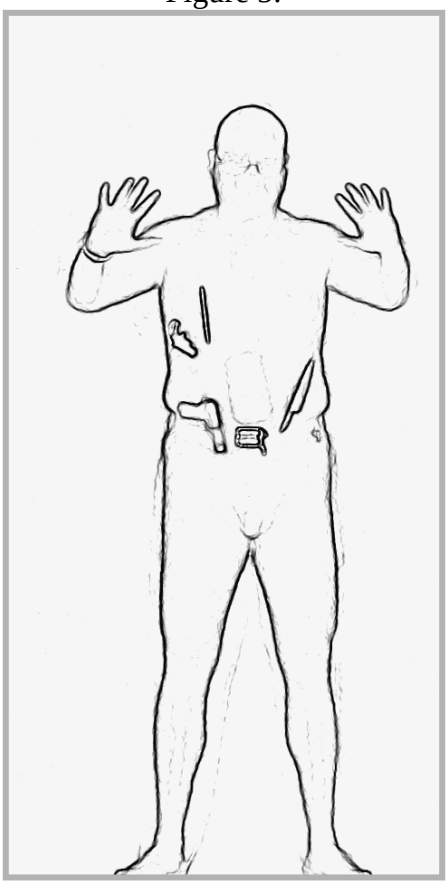


Figure 6: